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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/826,443	04/04/2001	Eric John Hewitt	AHA-02201	6524
28960	7590	11/04/2004		
HAVERSTOCK & OWENS LLP 162 NORTH WOLFE ROAD SUNNYVALE, CA 94086			EXAMINER ABRAHAM, ESAW T	
			ART UNIT	PAPER NUMBER

2133

DATE MAILED: 11/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/826,443

Applicant(s)

HEWITT ET AL.

Examiner

Esaw T Abraham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on amdt filed on 06/01/04.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10/04/04 and 08/19</u> . | 6) <input type="checkbox"/> Other: _____  |

**Final rejection**

**Response to the applicant's amendments**

\*\*\*\*\*Amended claims 2, 10, 16, 16 are accepted by the examiner.

**Response to the applicant's argument**

Applicants argument's with respect to amended claims 2, 10, 15 and 16 filled in 06/01/04 have been fully considered but they are not persuasive.

The applicant argues that the prior art (Sindhushayana) does not teach a software solution within the TPC and does not disclose generating LLR probabilities. However, the argument is not convincing since Sindhushayana teach a method and an apparatus for computing soft decision input metrics to a turbo decoder includes circuits associated with 8-ary phase shift keyed (8PSK) modulation and 16-ary quadrature amplitude modulation (16QAM) and in both implementations log-likelihood ratio (LLR) metrics on code symbols are estimated as products of various constant values and various combinations of the in-phase and quadrature components of a demodulated soft decision (see abstract). Therefore, the applicants' argument although acknowledged, has not been found to be convincing.

Further the applicant argues that the prior art (Sindhushayana) does not teach approximating a log-likelihood result of an input signal that is independent of a signal to noise ratio. However, this argument is moot because the claimed language does not taught or supported in the specification, for example (see the first paragraph of page 9) and further it is not understood what the phrase "LLR result is independent of signal to noise ratio value" and if the LLR result is not dependent of the N/S ratio what is it depend on. Therefore, the absence of "independent of S/N ratio" as in claims 2, 10 do not make the claims allowable since the main

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goal approximating LLR within a turbo product code system is to improve or to enhance link or channel performance.

### **DETAILED ACTION**

1. Claims **2 to 21** are presented for examination.

#### ***Claim objections***

2. Claims 2, 10, 15 and 16 are objected to because of the following informalities:

(a) Please change the term "TPC" -to- "turbo product code" (in claims 2, 10, 15 and 16).

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims **15 and 16** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite in that it fails to point out what is included and excluded by the claim language with the use of the phrase: "**substantially**" (see claim 15, page 5 line 20) and (see claim 16, page 5 line 7).

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

Rejection under 35 U.S.C. 102(e), Patent to Another with earlier Filing date, Reference is a U.S. Patent Issued Directly or Indirectly From a National Stage of, or a Continuing Application Claiming benefit under 35 U.S.C. 365© to, an International Application Having an International Filling Date Prior to November 29, 2000.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims **2-15** are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Sindhushayana (PN: 6,594,318).

As per claims **2 and 10**, Sindhushayana teach a method and an apparatus for computing soft decision input metrics to a turbo decoder includes circuits associated with 8-ary phase shift keyed (8PSK) modulation and 16-ary quadrature amplitude modulation (16QAM) and in both implementations log-likelihood ratio (LLR) metrics on code symbols are estimated as products of various constant values and various combinations of the in-phase and quadrature components of a demodulated soft decision (see abstract and col. 23 last paragraph).

As per claim **3-7**, Sindhushayana teaches all the subject matter claimed in claim 2 including log-likelihood ratio computation module coupled to the demodulator and configured to receive the complex-valued modulation symbol soft decision from the demodulator, scale the complex-valued modulation symbol soft decision to obtain a log-likelihood ratio metric for a most-significant turbo encoded symbol of the modulation symbol, and apply a linear combination of a triangle function and a ramp function to the complex-valued modulation symbol soft decision to obtain log-likelihood ratio metrics for remaining turbo encoded symbols of the modulation symbol (see claim 6).

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As per claims **8 and 9**, Sindhushayana teaches all the subject matter claimed in claim 2 including linear approximation for the LLR associated with each code symbol is performed for a square QAM constellation and from FIGS. 14-16 it may be seen that for any  $4 \cdot \sup.m$ -QAM constellation with  $m > 0$ , the function  $\text{LLR.sub.m-1}(x)$  is an odd function of  $x$ , and may be approximated by a straight line whose slope coincides with the slope of  $\text{LLR.sub.m-1}(x)$  at  $x=0$  (see col. 24, lines 10-21).

As per claims **11 and 12**, Sindhushayana teaches all the subject matter claimed in claim 10 including log-likelihood ratio computation module coupled to the demodulator and configured to receive the complex-valued modulation symbol soft decision from the demodulator, scale the complex-valued modulation symbol soft decision to obtain a log-likelihood ratio metric for a most-significant turbo encoded symbol of the modulation symbol, and apply a linear combination of a triangle function and a ramp function to the complex-valued modulation symbol soft decision to obtain log-likelihood ratio metrics for remaining turbo encoded symbols of the modulation symbol (see claim 6).

As per claims **13 and 14**, Sindhushayana teaches all the subject matter claimed in claim 10 including linear approximation for the LLR associated with each code symbol is performed for a square QAM constellation and from FIGS. 14-16 it may be seen that for any  $4 \cdot \sup.m$ -QAM constellation with  $m > 0$ , the function  $\text{LLR.sub.m-1}(x)$  is an odd function of  $x$ , and may be approximated by a straight line whose slope coincides with the slope of  $\text{LLR.sub.m-1}(x)$  at  $x=0$  (see col. 24, lines 10-21).

As per claim **15**, Sindhushayana teach a method and an apparatus for computing soft decision input metrics to a turbo decoder includes circuits associated with 8-ary phase shift

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keyed (8PSK) modulation and 16-ary quadrature amplitude modulation (16QAM) and in both implementations log-likelihood ratio (LLR) metrics on code symbols are estimated as products of various constant values and various combinations of the in-phase and quadrature components of a demodulated soft decision (see abstract and col. 23 last paragraph). Further, Sindhushayana teaches all the subject matter claimed in claim 2 including log-likelihood ratio computation module coupled to the demodulator and configured to receive the complex-valued modulation symbol soft decision from the demodulator, scale the complex-valued modulation symbol soft decision to obtain a log-likelihood ratio metric for a most-significant turbo encoded symbol of the modulation symbol, and apply a linear combination of a triangle function and a ramp function to the complex-valued modulation symbol soft decision to obtain log-likelihood ratio metrics for remaining turbo encoded symbols of the modulation symbol (see claim 6).

Furthermore, Sindhushayana teaches all the subject matter claimed in claim 10 including linear approximation for the LLR associated with each code symbol is performed for a square QAM constellation and from FIGS. 14-16 it may be seen that for any  $4^{\text{sup.m}}$ -QAM constellation with  $m \geq 0$ , the function  $\text{LLR.sub.m-1}(x)$  is an odd function of  $x$ , and may be approximated by a straight line whose slope coincides with the slope of  $\text{LLR.sub.m-1}(x)$  at  $x=0$  (see col. 24, lines 10-21).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject

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matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
5. Claims **16-21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sindhushayana (PN: 6,594,318).

As per claims **16 and 21**, Sindhushayana teaches a technique for computing soft-decision input metrics to a turbo decoder and a method of approximating log-likelihood ratio metrics for a plurality of turbo encoded symbols, the plurality of turbo encoded symbol having been modulated with quadrature amplitude modulation (QAM) signal constellations having gray code labeling, is provided and further the method includes the steps of extracting a complex-valued modulation symbol soft decision on a modulation symbol, whereby the complex-valued modulation symbol soft decision having an in-phase component (I) and a quadrature component (Q); scaling the complex-valued modulation symbol soft decision to obtain a log-likelihood ratio metric for a most-significant code symbol of the modulation symbol (see figure 8 elements 406, 410, 412, 414 and col. 3, lines 27-48). Further, Sindhushayana in figure 2 disclose a receiver (40) includes a demodulator (44) coupled to an automatic gain control (AGC) (46) that is coupled to a converter (ADC) (48) whereby the output of the ADC represents digital samples

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provided to LLR computation circuit (see col. 10, lines 22-33) **Not explicitly disclosed** converting module for converting the LLR result of (I, Q) symbols into unsigned values. **However**, Sindhushayana teach a common scale, referred to as log-likelihood ratio (LLR) probabilities, represents each bit by an integer in some range, e.g., [-32,31] and a value of 31 (unsigned or positive) signifies a zero with very high probability and a value of -32 signifies a one with very high probability (see col. 2, lines 37-45). **Therefore**, it would have been obvious to a person having an ordinary skill in the art at the time the invention was made to represent the converted LLR result as signed or unsigned values since assigning as signed or unsigned is conventional and well known. **This modification** would have been obvious because a person having ordinary skill in the art would have been motivated to simplify the decoding configuration and maximize the decoding efficiency.

As per claim 17, Sindhushayana teaches all the subject matter claimed in claim 16 including Sindhushayana in figure 2 disclose a receiver (40) includes a demodulator (44) coupled to an automatic gain control (module) (AGC) (46) that is coupled to a converter (ADC) (48) whereby the output of the ADC coupled to an input of a first receiver multiplier (50) to LLR computation circuit (see col. 10, lines 22-33)

As per claim 18, Sindhushayana teaches all the subject matter claimed in claim 16 including LLR computation for PSK constellations is performed and each modulation symbol represents a particular string of code symbol values, defined by its labeling (see col. 23, lines 34-40).

As per claims 19 and 20, Sindhushayana teaches all the subject matter claimed in claim 16 including Sindhushayana teaches a technique for computing soft-decision input metrics to a

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turbo decoder and a method of approximating log-likelihood ratio metrics for a plurality of turbo encoded symbols, the plurality of turbo encoded symbol having been modulated with quadrature amplitude modulation (QAM) signal constellations having gray code labeling, is provided and further the method includes the steps of extracting a complex-valued modulation symbol soft decision on a modulation symbol, whereby the complex-valued modulation symbol soft decision having an in-phase component (I) and a quadrature component (Q); scaling the complex-valued modulation symbol soft decision to obtain a log-likelihood ratio metric for a most-significant code symbol of the modulation symbol (see figure 8 elements 406, 410, 412, 414 and col. 3, lines 27-48). Further. Sindhushayanate teach that an estimates of the LLR metrics obtained in association with generalized square QAM and M-ary PSK modulation schemes including, e.g., 64QAM, 256QAM, and 16PSK (see abstract).

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

**Conclusion**

9. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Esaw Abraham whose telephone number is (571) 272-3812. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are successful, the examiner's supervisor, Albert DeCady can be reached on (571) 272-3819. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

*Esaw Abraham*  
Esaw Abraham

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GUY J. LAMARRE  
PRIMARY EXAMINER

